

Critical Thinking and Inquiry in the Natural Sciences

Assessment Rubric

Definition

In Critical Thinking and Inquiry competency courses, students acquire a working knowledge of the foundational tools for reasoning, including constructing sound arguments, evaluating the quality of evidence, and forming judgments about the evidence, arguments, and conclusions of others in natural science disciplines.

Framing Language

A course approved in the Critical Thinking and Inquiry in the Natural Sciences competency should have an intense focus on critical thinking and the fundamentals of inquiry in the context of the natural sciences. Critical thinking and inquiry should be explicit parts of the course design. In the context of natural sciences, critical thinking means explaining, predicting, and reasoning about the behavior of natural systems, or the outcomes of observations or measurements, using arguments based on established scientific principles and models. In the context of natural sciences, inquiry means developing, deepening, refining, or extending concepts, principles, and models to explain natural systems, based on empirical observations or thought experiments.

Glossary

Assumptions – beliefs about a claim, argument, artifact, or information that shape one's understanding of it or make an understanding of its significance possible

Context – related aspects of a claim, argument, artifact, or information that indirectly affect an understanding of its significance

Rubric Key

Dimension – A dimension expresses a fundamental aspect of a given Student Learning Outcome.

Level – The levels of learning describe progressive achievement, moving from Developing (Level 1) to Sophisticated (Level 4). Basic Competence in this MAC competency is achieved at Level 2. Students should be given opportunities to develop further levels of achievement in their upper-level, program-specific courses, after their initial introductory-level exposure to its fundamentals in a MAC-designated course.

SLO – A Student Learning Outcome (SLO) expresses the core learning goals of a curriculum. This rubric presents the SLOs for this MAC competency. Any course designated to deliver this competency is expected to state these SLOs verbatim in the course syllabus and to foreground them in its design and delivery.

SLO #1: Critically analyze claims, arguments, artifacts or information.				
Dimensions	Sophisticated competence (Level 4)	Enhanced competence (Level 3)	MAC (Basic) competence (Level 2)	Developing competence (Level 1)
Critical Analysis	Accurately and clearly identifies general features of claims, arguments, artifacts, or information. Analyzes claims, arguments, artifacts, or information with thorough support of reasoning, evidence and/or data, all of which is reliable, appropriate to the task, and persuasive. Effectively situates claims, arguments, artifacts, or information in broader contexts of inquiry by articulating motivating questions, underlying assumptions, competing interpretations, and/or implications for future inquiry.	Accurately and clearly identifies general features of claims, arguments, artifacts, or information. Analyzes the reasoning, evidence and/or data that underlies claims, arguments, artifacts, or information in terms of its strengths and weaknesses and/or in light of alternative explanations or counterarguments. Recognizes that claims, arguments, artifacts, or information are situated in broader contexts of inquiry. Where appropriate, articulates the questions motivating the analysis.	Identifies general features of claims, arguments, artifacts, or information in a mostly accurate and clear way. Articulates reasoning, evidence and/or data that underlies claims, arguments, artifacts, or information. Offers some interpretation of reasoning, evidence and/or data in terms of quality, appropriateness, and/or assumptions, though possibly in uneven, partially inaccurate and/or incomplete ways.	Identifies general features of claims, arguments, artifacts, or information, though their representation lacks accuracy and/or clarity. Minimally articulates the reasoning, evidence and/or data that underlies claims, arguments, artifacts, or information, paying little attention to its quality, appropriateness, and/or underlying assumptions.

SLO #2: Construct coherent, evidence-based arguments.				
Dimensions	Sophisticated competence (Level 4)	Enhanced competence (Level 3)	MAC (Basic) competence (Level 2)	Developing competence (Level 1)
Argument Construction and Inquiry Fundamentals	Formulates a research question and derives a clear thesis claim from that question. Identifies and justifies appropriate methods for collecting and analyzing reasons, evidence and/or data used to assess the thesis claim. Reasoning, evidence and/or data is of high quality (precisely tailored, well-defined, varied, appropriately sourced, etc.) and is used to build a well-organized, persuasive argument. Where appropriate, justifies the strength or validity of the argument in light of competing counterarguments or alternative interpretations.	Identifies a clear research question and derives a clear thesis claim from that question. Supports the thesis claim with appropriate, reliable and well-organized reasoning, evidence and/or data. Concepts are defined and applied clearly. Where appropriate, assesses the strength or validity of the argument in light of possible counterarguments or alternative interpretations.	Identifies a research question and articulates a thesis claim that responds to that question. Supports the thesis claim with reasoning, evidence and/or data that is broadly relevant, though some of it may come from inappropriate or unreliable sources. Where appropriate, attempts to define technical or otherwise key concepts.	Makes a claim and attempts to support that claim with reasoning, evidence and/or data. The claim, or its support, may be simplistic, incoherent, convoluted or not obviously relevant to the task.

Revised version. Approved by the General Education Council, April 2023.